Vol. IX. No. 1 March 1957

DIRECTORATE OF PLANT PROTECTION, QUARANTINE AND STORAGE
MINISTRY OF FOOD AND AGRICULTURE, GOVERNMENT OF INDIA

PLANT PROTECTION BULLETIN

SCIENCE IN PRACTICE

Issued by the
PLANT PROTECTION ADVISER TO THE GOVERNMENT OF INDIA
NEW DELHI

[1959] (see last page)

Published Quarterly

		Inland	Foreign
SUBSCRIPTION RATES	Single Copy	Re. 0.75	1*sh.*
	Annual	Rs. 3.00	5*sh.*

Available from:

THE MANAGER OF PUBLICATIONS, CIVIL LINES, DELHI—8

Vol IX, No. 1 March 1957

DIRECTORATE OF PLANT PROTECTION, QUARANTINE AND STORAGE
MINISTRY OF FOOD AND AGRICULTURE, GOVERNMENT OF INDIA

PLANT PROTECTION BULLETIN

SCIENCE IN PRACTICE

Issued by the
PLANT PROTECTION ADVISER TO THE GOVERNMENT OF INDIA
NEW DELHI

NOTE

This Bulletin is intended to disseminate information about plant protection measures and campaigns adopted or conducted in different parts of India as well as about the advances made in the field of plant protection in other parts of the world to the extent possible. It is also intended to give information about the latest developments in the production and use of pesticides and plant protection equipment as well as about techniques of pest and plant disease control. Elaborate scientific papers on Entomology or Plant Pathology or on the chemistry of pesticides would normally not be in place in this Bulletin but short notes dealing with the behaviour or distribution of pests and plant diseases and brief reports on their epidemiology, control etc., would be welcome. Plant protection has now become such a specialised science and yet is so diversified and consequential in its character and application that it is difficult to define the scope of the subject with any great precision. The general rule to be observed is that any information which can be useful in preventing or controlling damage to crops, fruit trees, plantations and stored agricultural commodities, caused by pests and diseases, should be a fit subject for publication in this Bulletin.

Manuscripts submitted for publication in the Plant Protection Bulletin must be typed in double spacing on one side of the paper only, leaving ample margin on the left, at the bottom and on the top of the page. Photographs or drawings must be accompanied by a clearly typed legend for being reproduced under them. In addition, they should bear, on their reverse in clear handwriting in pencil, the name or names of the author or authors and the article which they illustrate. Local names of insects, diseases, weeds, crops and plants, if used, must be commenced with a small, not capital letter and underlined and must invariably be followed by their scientific or well known English names. Localities or place names should be clearly indicated by reference to well known districts or States or both.

While this Directorate will take every care to include only such material in the Bulletin as may be considered reasonably correct and useful, it can accept no responsibility for every statement made and every opinion expressed. Due to various unavoidable reasons the appearance of this Bulletin has been far behind the scheduled time. While this must be greatly regretted, every effort would be made to avoid delays in future. Those who may read this Bulletin are invited to offer criticisms and suggestions for its improvement.

K. B. LAL
PLANT PROTECTION ADVISER TO THE GOVERNMENT OF INDIA

NEW DELHI

PLANT PROTECTION AND INTENSIVE DRIVE FOR BETTER PRODUCTION*

By

P. S. Deshmukh,

Union Minister for Agriculture.

The importance of Plant Protection activity was vividly realised during the last war when the acute shortage of food focussed attention on the need to increase production and to conserve properly what was produced. One of the main conclusions of the Indian Famine Enquiry Commission of 1945 was that "If the full benefits of irrigation, manuring and improved varieties are to be assured, effective action must be taken to deal with diseases, pests, vermins and weeds." The Commission considered, therefore, that crop protection was an important factor in increased production and recommended that special plant protection staff should be employed in every State for this particular purpose.

During the period of the First Five-Year Plan, the work of controlling pests and plant diseases was intensified and extended in many directions. Technically, many modern insecticides and fungicides for destroying insect and other pests and plant disease organisms were brought into use, many new treatments were evolved and many spraying, dusting, fumigating and seed-dressing machines were employed over extensive areas. Organisationally, the Central Directorate of Plant Protection, Quarantine and Storage as well as the Plant Protection Services in the States were strengthened and improved and efforts were made to convince farmers about the value of plant protection measures and gain their co-operation in the large scale adoption of such measures. Innumerable demonstrations were held on the control of grasshoppers, blight diseases of potato, seed-borne diseases of cereal crops and field rats, to mention only a few out of dozens over which such demonstrations were held. Still there are about 300 pests and diseases which constitute the enemies of our farmers in this country. Apart from demonstrations, many large-scale campaigns against crop pests, notably locusts, and diseases, were conducted by plant protection and other organisations of the Central and State Governments, in most of which farmers freely joined.

It is interesting to note that the total crop and orchard area in India receiving various treatments for pest and disease control through Government organisations increased from 2·5 million acres in 1951, 4·7 million acres in 1952, 6·6 million acres in 1953, to 9·3 million acres in 1954. On the basis of 10 million acres of crop area treated and on the very moderate assumption of plant protection measures adding an over all

*Radio talk broadcast over the All India Radio on 17-7-56. By the courtesy of the Director General, All India Radio.

average of only two maunds of crop produce to the acre, the net production gain is 0·74 million tons. The need for intensifying our efforts in this direction is, therefore, obvious.

Unfortunately, the period of the First Five-Year Plan coincided with an epidemic of locusts, which periodically become active and invade our country in large swarms. The successful control of this epidemic has been one of the major achievements of the Directorate of Plant Protection, Quarantine and Storage which has operated for this purpose with modern equipment and technically trained staff over an area of about 81,000 square miles in the deserts of Rajasthan, PEPSU, Saurashtra, Kutch and Bombay States. Although locusts seem to have left us for the present, the need for vigilance over them remains. We are, therefore, maintaining a permanent Locust Warning Organisation and are also collaborating in international efforts to control locusts. Early this year we sent out a team of 30 officials with equipment for conducting an anti-locust campaign in Saudi Arabia and Kuwait under the auspices of the F.A.O., for the second year in succession. The team has just returned after conducting a successful campaign over an area of about 50,000 square miles. Some research on locusts has already been started and the Second Five-Year Plan provides for the establishment of a Field Laboratory at Bikaner for investigations on these pests.

It has been felt that during periods of severe pest or disease epidemics, the resources of the State Governments are usually not adequate to the requirements. It has also not been considered necessary that the States should maintain unduly large organisations which, though required in periodical or serious emergencies, may not always be utilised to the full normally. To meet this difficulty, the Government of India sanctioned the establishment of a Central Pool of Plant Protection Equipment during the First Five-Year Plan with Centres at ten different places in India from where the necessary equipment and other facilities may be made available to the State Governments to fight pest and disease epidemics together with their own available resources. Five of these Centres at Delhi, Palanpur, Indore, Hyderabad and Trichinopoly have already been established and the others are in the course of being established. During the Second Five-Year Plan, it is proposed to not only strengthen these Centres but also to add four more to their number thereby making a total of fourteen Centres for the whole of India. However, these Centres would not be concerned merely with lending staff and equipment to the States but would also actively assist in various programmes designed to improve plant protection work, *e.g.*, training of personnel, surveys of pest and disease incidences and evaluation of results.

During the last four years, many uses have been made of small aeroplanes for dusting or spraying of crops to control pests or diseases. There are many limitations on the use of aeroplanes in crop protection work,

but it has now been well recognised that under certain conditions and situations, they provide the most effective means of covering large areas with sprays or dusts to kill pests or disease organisms in a very short time when the speed of action is the most urgent requirement. During the years 1951 to 1954, aeroplanes have been employed to destroy locusts in Rajasthan and some other areas and also some other pests in specific States and the performances have been full of promise. The Union Ministry of Food and Agriculture have, therefore, decided to obtain three aeroplanes as a starting unit for aerial operations against pests and diseases whenever these operations are required to be conducted in any State of India. Two at least of the aeroplanes of this aerial unit are expected to arrive in India during this year and, it is hoped, would materially contribute to the large-scale control of pests and diseases of crops and plantations.

Crops have to be protected not only from pests and diseases which may already be present in the country, but also from those which, though not occurring in India, may be accidentally introduced from foreign countries through the imports of plants and plant materials. It has been necessary, therefore, to develop a system of plant quarantine at the points from which foreign consignments of plants and plant materials, liable to carry pests and diseases, may enter India, so that they may be properly inspected and suitably treated before being allowed to go further inland. For this purpose, plant quarantine or fumigation stations have been established at the seaports of Bombay, Cochin and Madras and at the airport of Amritsar. A Plant Quarantine Station at the seaport of Calcutta is about to be established. In the Second Five-Year Plan, provision has been made for establishing Plant Quarantine Stations at two more seaports, namely Visakhapatnam and Kandla, at the land frontier near Amritsar and at the airports of Delhi, Bombay, Madras and Calcutta which handle international traffic.

During the First Five-Year Plan period, the total expenditure, incurred by the various State Governments on their plant protection organisations, was over Rs. 220·00 lakhs excluding about Rs. 77·51 lakhs contributed by the Government of India under the Grow More Food Schemes. During the same period, the Government of India spent approximately Rs. 105 lakhs on their Central Plant Protection Directorate and on the control campaign against pests and plant diseases conducted by the Directorate. The total expenditure on plant protection during the First Plan period was, therefore, about Rs. 403·00 lakhs. In the Second Five-Year Plan, a new provision of Rs. 310·36 lakhs for plant protection has been made in the agricultural budgets of the State Governments and Rs. 39·20 lakhs in that of the Central Directorate of Plant Protection. The total expenditure during the five-year period is likely to be about Rs. 310·00 lakhs in the States and over Rs. 156·00 lakhs in the Central Directorate of Plant Protection. To this may be added a contribution of at least Rs. 128 lakhs to be

made by the Central Government to the States under the Grow More Food Schemes. The figures for the States and the Directorate of Plant Protection do not, however, include any large-scale expenditure that may have to be incurred for locust control. As at present anticipated, therefore, the total expenditure on plant protection in the country as a whole during the Second Plan period is likely to be at least Rs. 634 lakhs, that is, an increase of about Rs. 231 lakhs over the previous expenditure.

During the First Five-Year Plan we made an all-out and, I am glad to say, a very successful effort to increase our food production by extending and intensifying the cultivation of cereal crops. While we must still attach great importance to food production, the emphasis in the Second Five-Year Plan has shifted to increasing the production of not only cereal crops but also of various types of protective foods. Secondly the effort now is to increase the yield per acre rather than to extend the acreage under crops. Protective foods which can be grown are fruits and vegetables and sugar-cane and these are the crops which are very susceptible to the attacks of a great many pests and diseases. Intensive cultivation also demands, among other things, the avoidance of waste and damage to crops through pest and disease attacks. Therefore, plant protection assumes far greater importance in the Second Five-Year Plan than it had in the First. Although basic plans have already been made, we are still examining the ways and means by which damage to crops, orchards, plantations and stored agricultural commodities may be further minimised.

Before I conclude, however, I wish to take this opportunity of addressing an appeal to all my listeners. As you may well remember, the Prime Minister and the National Development Council want us to aim at still higher targets than have been provided for in the present draft of the Second Plan. I made bold the other day to convey a solemn assurance that whether the targets are raised or not, we will continue to strain every nerve to produce more and more, in spite of adverse climatic conditions and other difficulties. In fact the chronic floods and droughts only serve as rude reminders that we cannot relax. This is, however, the time for sowing paddy as well as of transplantation. It should be our aim and concern to put under the Japanese method the maximum area possible. The practice of this method makes good seed go at least 8 times further and good seed is highly important. The method of broadcasting leads to waste of good seed and yields less. It should, therefore, be replaced by line sowing wherever possible. Line sowing of seed should yield place to sowing by hand or dibbling as it is called. Not content with what we may achieve according to our present plans, we have already launched a fresh fertiliser campaign. A couple of days back, we decided not to leave this to any chance but to fix specific targets and work towards their attainment. We have thus fixed 25 lakhs of acres to be specially fertilised with Ammonium Sulphate and other fertilisers in the course of the next 5½ months of the

year 1956. This area is to be new and additional. If there is no time to administer fertilisers to the paddy crop before sowing because it is already sown or transplanted, we wish that all concerned should help the cultivators to administer a dose of Ammonium Sulphate at a later stage but at least 15 days before the flowering stage of rice is reached. The Community Projects Administration have assured us every co-operation and intensive action. I have every hope that all others concerned with the matter would utilise this co-operation and also give their own in the amplest measure. I hope, therefore, that my colleagues in the States, the Directors of Agriculture, their officers and field-men as well as the Development Commissioners and the Extension Staff will immediately set out to plan this campaign physically. Beginning will have to be made by getting the necessary fertilisers or utilising the present stocks. They should be kept in readiness in as many centres as possible so that it may be used on the widest possible area and there will be no delay or difficulty in the farmer getting it. If it is possible to recommend mixtures, steps may be taken to make them and distribute them in that form. The minimum area we have fixed for fertilizing in this way is 15 lakh acres under rice and 10 lakh acres under wheat. This does not, however, mean that the other crops are to be neglected. No. Nothing of the sort. Efforts to popularise its use on other crops should in no case be slackened also. Under the First Five-Year Plan, we were asked to produce 76 lakh tons of more foodgrains by 1955-56. Actual figures show that we produced very nearly twice as much as this not only in 1955-56 but in each one of the last four years beginning from 1952-53. But even this is not enough for the country and our people as the need of importing a small quantity of foodstuffs even for reserve has demonstrated. I am fully confident that we are capable of exceeding our previous performances because we have already created a tempo for better production amongst our cultivators. We have also more facilities both of manpower, water and chemicals available and there is a call from the Nation that we must at all costs, do better than what we have done in the past. Nobody could have the privilege of serving a nobler cause than the better and adequate feeding and clothing of our people and none could be entitled to feel more proud than ourselves provided we fulfil our obligations to the Nation.

NON-INSECT ANIMAL PESTS

By

K. B. Lal,

Plant Protection Adviser to the Government of India, New Delhi.

While the damage caused by insect pests to crops, etc., is readily appreciated, there is not the same awareness about the damage caused by various other animals which are not insects. A list of such animals, together with their distribution as pests in the different States of India and the crops they damage, is given at the end of this article. While insect pests may be controlled by the spraying and dusting of chemicals on crops, etc., remedies against non-insect pests may lie in mechanical, administrative and other measures.

The following are some comments on the present possibilities of controlling non-insect animal pests:—

Elephants, Blue Bulls, Wild Cattle, etc.

Fencing of fields, wherever fencing materials, barbed wire for example, may be available at reasonable costs, should help. Long-term loans to farmers to purchase fencing materials may be considered. Creation of effective obstructions in the paths of the invading animals, provided such restricted paths exist, may be a supplementary effort. Killing of wild cattle and blue bulls by shikaries, both professional and amateur, has not made much difference. A scheme for catching wild cattle has been in operation in the Punjab (Old PEPSU) but the degree of relief afforded to farmers by this means is not known.

Monkeys

Orissa and the Punjab States have offered cash rewards for the killing of monkeys and *ad hoc* efforts have been made in the Punjab, Uttar Pradesh and perhaps other States for catching monkeys and releasing them in distant forests. The export of monkeys to the U.S.A. makes no impression on monkeys population. While these efforts need not be discouraged or abandoned, they do not afford the required relief from monkeys. The creation of wholesale sterility in monkeys by feeding them (in their natural haunts) with suitable drugs should be seriously considered. So far such drugs are not known but there is a good possibility of their being discovered.

Jackals

Jackals severely damage sugarcane and other crops and poison baits have been used to destroy them, specially in the Punjab. Recently, it appears that farmers are making use of dead animals by putting small amounts of strychnine hydrochloride or zinc phosphide (poisons used for killing rats)

in the body of the animals and leaving them out in the field for the jackals to feed on, which thereby take the poison and die.

Rats

Rats are destroyed by means of poison baits or by the fumigation of their burrows with hydrocyanic acid gas or by both the methods undertaken simultaneously. These remedies are quite effective, but they have to be applied simultaneously on a large area and persistently after intervals of six months or so. Rat control is now more a matter of organising rat killing campaigns than discovering any new method. In such campaigns the people's participation to the utmost is essential.

Porcupines

Porcupines dig up potato and other root crops and also damage gram and other crops. The only remedy available is either to effectively fence the crops or to conduct a campaign for shooting porcupines during night as they come to the fields. Porcupine burrows may be fumigated with calcium cyanide powder, but it is difficult to find them and make sure that they are inhabited by porcupines.

Flying Foxes

Flying foxes cause damage to citrus, apple, peach, guava, coconut and other fruits in many parts of India and the campaign against them must be conducted on a regional basis. This Directorate has conducted some trials with small bombs which, when fixed to the trees on which the flying foxes are roosting and ignited by means of a fuse at some distance from the tree, brings down the animals in large numbers which may then be killed. The limitation of the method is that it cannot be used near human habitations. The operation is technical and somewhat dangerous, but groups of men can be trained to undertake it.

Parrots, Crows, Sparrows and other Harmful Birds

Parrots damage unripe mango and other fruits and also food crops. Many birds pick up the seeds as they are sown in the soil and have constituted one strong reason against the dibbling method of sowing wheat and other cereals. Farmers have preferred to sow excessive amounts of seed in the hope that even if a proportion of them is picked up by the birds, sufficient seed would still be left in the soil to produce a reasonable crop. No satisfactory method of controlling birds is known and the method of putting up scare crows in the field is not efficient. Keeping off the birds by flinging stones tied at the end of small ropes is laborious. There is a small machine available in the market, costing Rs. 187 to Rs. 220, which makes loud reports like that of a gun-fire at intervals of half a minute to five minutes, as adjusted.

The machine is worked by calcium carbide and the working cost is stated to be Rs. 0·75 for 6 to 12 hours. The snag is that the birds may become accustomed to the reports of the machine and ignore it. Secondly,

it is not known clearly what would be the distance radially, up to which the birds would be effectively scared off. Some farmers in Madhya Pradesh are 'dressing' their groundnut (before sowing) with Agrosan GN, an organo-mercuric compound, to poison crows which pick up the nuts from the field. It may be a fruitful line of investigation by some University or the Zoological Survey of India to find out the breeding and nesting habits of the injurious birds so that, if possible, a mass campaign for the destruction of their eggs and nests may be undertaken.

Tortoises

The trouble with tortoises, which feed on young *singhara* fruit (*Trapa bispinosa*), is localised at present to Delhi and western Uttar Pradesh. The *singhara* growers have adopted the practice of feeding the tortoises on parched rice or maize in an effort to wean them away from the *singhara* crop. The method is said to be economical and successful.

Crabs, Snails and Slugs

Crabs cause damage to young paddy plants by cutting them from the base. Snails and slugs feed on vegetable crops and sometimes become serious pests specially when the plants are young. These pests can be controlled by poison baiting with metaldehyde, a comparatively new chemical.

Mites

Mites are well known crop pests and damage sugarcane, cotton, vegetables, mango, litchi, jute, tea, etc. They are controlled by dusting or spraying with sulphur or some new acaricides.

Eelworms

These belong to the group of nematodes (round worms) and are responsible for causing ear cockle in wheat and root or stem knots in paddy, brinjal, potato, citrus, tea, etc. Galled wheat grains, which harbour the nematodes, are separated by floatation method or sieved by mechanical devices to obtain healthy grains. This Directorate has procured a Nematode Eliminator machine from China, which separates the healthy from the galled wheat grains to the extent of 99·9% at the rate of $1\frac{1}{2}$ maunds of wheat per hour according to our tests. The floatation method, which is largely practised in the Punjab, achieves this result to the extent of about 90% only. Sterilisation of the soil by chemicals, like dichloropropane dichloropropylene, or some other soil fumigant and crop rotation are generally recommended against soil nematodes.

Some other suggestions for the control of non-insect animal pests are contained in a book entitlted, "BETWEEN US AND HUNGER" by C. Mayadas, Chapter IV, pages 28—36, published in 1954.

The list, presented herewith, was prepared on the basis of information received from the State Departments of Agriculture in reply to a comprehensive questionnaire issued by this Directorate in March, 1955

Thereafter, the list was discussed and checked in the All-India Plant Protection Conference held at New Delhi in August, 1956.

The information received from the States as well as subsequent discussions in the Plant Protection Conference at New Delhi showed that:—

(*i*) No studies or surveys have been undertaken anywhere in India to determine the extent of losses, caused by non-insect animal pests. However, losses through one or other of such pests are heavy in all the States. (*ii*) No effective and economically feasible measures of control against these pests, except against rats, snails, eelworms, mites and possibly jackals, were available. Some measures adopted against some other non-insect animal pests in some States, have included offering of rewards for the killing of monkeys, catching of wild cattle, providing assistance for the fencing of fields and liberalising the policy of issuing gun licences for crop protection purposes. These measures have been attended with varying degrees of success, usually inadequate. (*iii*) There is a distinct need to institute surveys and investigations on non-insect animal pests on an all-India or regional basis and that the Directorate of Plant Protection, Quarantine and Storage should initiate such work in collaboration with the State concerned.

(*List on page* 10)

DISTRIBUTION OF NON-INSECT ANIMAL PESTS OF CROPS IN INDIA

(Based Mainly on Reports Received from the States in India)

Pest*	Distribution	Crop Damaged
Bears	Jammu & Kashmir, Madhya Pradesh, Manipur, Mysore and Punjab.	Fruits, vegetables and groundnut.
Birds (parrots, crows, sparrows, pigeons, doves, etc.)	All States.	Grain crops, fruits, groundnut, chillies, and seeds at sowing time.
Blue Bulls	Bihar, Bombay, Delhi, Jammu & Kashmir, Madhya Pradesh, Punjab, Rajasthan and Uttar Pradesh.	All crops, specially fodder crops.
Crabs	Andhra, Bihar, Bombay, Kerala, and West Bengal.	Paddy crop.
Deer & Antelopes ..	Andhra, Bombay, Madhya Pradesh, Punjab, Rajasthan, Uttar Pradesh and West Bengal.	All crops.
Eelworms ..	All States.	Wheat, paddy, citrus, brinjal, potato, etc.
Elephants ..	Assam, Kerala, Mysore, Orissa and Uttar Pradesh.	Paddy, sugarcane, millets, mango and plantain.
Flying Foxes ..	All States, except Manipur and West Bengal.	Fruits, including apple, peach, citrus, guava and coconut.
Jackals	All States, except Himachal Pradesh.	Maize, sugarcane, melon, pineapple and sweet potato.
Mites	All States.	Sugarcane, litchi, cotton, vegetables etc.
Mongoose ..	Madhya Pradesh.	Vegetables and fruits.
Monkeys ..	All States, except Kerala.	All crops, fruits, vegetables and some flower plants.
Porcupines ..	All States, except Andhra, Bihar, Madras and Mysore.	Mostly root crops and fruits.
Rabbits	All States, except Bihar, Madras, Manipur and West Bengal.	Vegetable crops and germinating cereals.
Rats	All States.	All grain and root crops, cotton, coconut, sugarcane and nursery stocks.
Snails and Slugs ..	Andhra, Bihar, Bombay and Orissa.	Water vegetables.
Squirrels	All States, except Himachal Pradesh, Jammu & Kashmir and West Bengal.	All crops and fruit trees.
Tortoises ..	Delhi, Punjab, and Uttar Pradesh.	*Singhara* fruit in early stages only.
Wild Boars ..	Andhra, Assam, Bihar, Bombay, Kerala, Manipur, Rajasthan, Uttar Pradesh and West Bengal.	All crops.
Wild cattle ..	Andhra, Kerala, Madhya Pradesh, Manipur, Orissa, Punjab and Rajasthan.	All crops.

*Arranged alphabetically.

AERIAL UNIT

The Ministry of Food & Agriculture (Department of Agriculture), Government of India, have established in 1957 an Aerial Unit in the Directorate of Plant Protection, Quarantine & Storage, consisting of three aeroplanes, two of which have already arrived and the third is expected some time in August or September, 1957. Two of the aeroplanes are Beavers (Agricultural Spray Model) and the third, an Auster Autocar.

The aeroplanes are being maintained by the Indian Airlines Corporation. A staff of pilots, ground engineers, mechanics and cleaners has been engaged. Under an Agreement with the F. A. O. a Pilot Specialist has been assigned to the Directorate for training some Indian pilots and helping in other ways in setting up the Aerial Unit. The aeroplanes are based at New Delhi and are available for service in any part of India.

All the three aeroplanes have single engines. The Beaver aeroplanes are powered by a 450 HP engine and can take a load of 192 imperial gallons of liquid or 1,664 lbs. of dust, excluding the pilot. Their cruising speed is 125 miles per hour, but the operational speed is only about 75 to 80 miles per hour. These aeroplanes are fitted both for spraying and dusting purposes.

The Auster Autocar has an engine of 145 HP and can take a load of 48 imperial gallons of spray liquid. Its cruising speed is about 93 miles per hour and recommended operational speed is about 50 to 70 miles per hour, This aircraft may be used for spraying locusts in flight.

Based on the maintenance cost, depreciation, consumption of fuel and oil, insurance of pilots, etc., and a standardised ferrying cost, the operational costs have been worked out to be Rs. 2,915 for the first 100 acres and thereafter Rs. 2·65 for every additional acre. This is the charge which the parties requisitioning the aeroplanes to any part of India would have to pay, excluding the cost of the pesticide used. The terms and conditions, under which the aeroplanes may be requisitioned, are as follows:—

1. The ferrying and other costs, both for aerial spraying and dusting have been at present fixed at Rs. 2,915 for the first 100 acres and Rs. 2·65 for every additional acre for a single aeroplane. If two or more aeroplanes are requisitioned by any party at the same time, each one of them would begin operations with the basic charge of Rs. 2,915.

2. The charges mentioned above exclude cost of pesticides, which may be provided by the Directorate of Plant Protection, the State Government or the parties requisitioning the aeroplanes.

3. All surface transport required for the carriage of the crew, including ground engineers, mechanics and cleaners, from hotels, rest houses, offices, etc., to airports and back would be provided by the parties requisitioning the aeroplanes. Likewise, labour for filling the aeroplane tank with pesticides as well as arrangements for their transport would have to be provided by them.

4. If an aerodrome is not situated within a distance of about 20 miles from the actual site of operation and a make-shift ground strip has to be prepared, about 300 yards long and 50 yards wide the cost of making such a strip would have to be borne by the party requisitioning the aeroplanes.

5. An additional charge of Rs. 100 per day would have to be paid by the party requisitioning the aeroplane if the aeroplane is allowed to remain idle for one or more days on account of lack of or delay in ground supporting arrangements. However, this charge would not be leviable if the aeroplane remains idle on account of its own defects or on account of unsuitability of weather for operational purposes.

6. The operational charges would be levied, irrespective of whether the aerial spraying or dusting has proved effective or not.

7. Normally five to seven days notice would be required for the aeroplanes to be flown from New Delhi to any other place in India.

8. The Government of India would not be responsible for any damage to crops, property or livestock, including fish, as a result of spraying or dusting from the air.

Requisitions for the aerial service should be sent to the Plant Protection Adviser to the Government of India, 4/19, Ajmere Gate Extension, New Delhi. A requisition form is reproduced here for guidance.

REQUISITION FOR AERIAL SERVICE

1. Party Requiring Aerial Service
2. Purpose Spraying/Dusting
3. Location of the Area to be treated
4. Crop
5. Acreage to be treated
6. Pest or Disease to be controlled
7. Pesticide to be used
8. No. of Aircraft Required
9. Distance and Location of the nearest Airport or Air Strip
10. Date on which the Aeroplane is required
11. The Party who will pay the Bill
12. Sponsoring authority

(*a*) *Signature*

(*b*) *Designation*

Place (*c*) *Address*

Date (*d*) *Telephone*

TRIALS OF SOME SYNTHETIC INSECTICIDES AGAINST SAN JOSE SCALE

By

L. N. Nigam and M. V. Venkatesh,

Directorate of Plant Protection, Quarantine & Storage, New Delhi.

Introduction

San Jose Scale is a notorious pest of a large variety of deciduous fruit trees in many parts of the world. It is considered to be a native of northern China and was observed first in 1873 in south California in the island of San Jose, after which it is named. It gradually spread to other areas in the U. S. A., where deciduous fruits were grown. It is believed to have entered India more than four decades ago and attracted the attention of fruit growers as a serious pest of deciduous fruit trees in 1922 in Kashmir, although it was noted earlier in the Kulu Valley (Punjab) on apple. The pest has spread to Himachal Pradesh, PEPSU, Uttar Pradesh, Orissa, West Bengal, Assam, Madras, Mysore and Bombay States.

There are about 200 host plants of this pest in different parts of the world. In India, it is common on deciduous trees of the family *Rosaceae* to which apple, plum, cherry, peach, apricot, etc. belong and is also found on poplar and willow and it sucks the sap of the plant through the bark, leaves and fruits, with the result that the growth of shoots and the yield of fruits, is adversely affected. The spotted fruits fetch less value in the market.

The problem of controlling this pest received serious attention of orchardists and entomologists in the beginning of this century in U.S.A. As the pest lies protected under a scaly covering, it is not easy to control it. Besides, some of the oils which were effective against the pest proved phytocidal to the plants and flower buds. The use of liquid lime sulphur, which came in later was also often accompanied by phytotoxicity. Besides, it produced resistance in the scale after repeated use.

In India, spraying with oil emulsion and lime sulphur became a common practice in Kashmir. The orchardists prepared the emulsions of different grades of oils in different proportions of the ingredients and in different ways, thus achieving varying degrees of success. The Indian Council of Agricultural Research started a scheme of investigations on the pest and the methods of its control in 1938. The scheme worked for about 10 years. As a result of the investigations, the spraying of fruit plants with diesel oil emulsion during dormant season came into wide use in Kashmir, Himachal Pradesh and other areas, while the use of liquid lime sulphur was gradually

given up. Although the spraying of apple orchards with diesel oil emulsion has become a routine practice with advanced growers, yet effective control of the pest has not been possible due to several drawbacks. As all the growers in the neighbourhood do not spray their orchards and as there are a number of alternate host plants, which are never sprayed, re-infestation often takes place. Besides, spraying techniques adopted by the orchardists and the method of preparing stock solutions of the emulsion are sometimes faulty and the spraying machines used are defective or give very low pressure. Higher concentration of oil cannot be used to effect a higher kill of the pest due to its phytotoxic action. The dormant period is so short that larger areas may not be easily covered. Also, the operations involve the cumbersome and time-consuming process of preparing oil emulsions almost every day in each orchard and the movement of large drums containing oil and soap in the interior of the hills is often very difficult for want of transport facilities.

With a view to finding out some ready-made emulsions in concentrated forms which could be more effective, less phytotoxic and easier to handle and to transport, trials were laid out to test the emulsions of a few synthetic insecticides.

Material and Methods

(*a*) *Insecticides used.*—Emulsions of five different insecticides, namely, Basudin, Folidol, Malathion, DNOC Winter Wash and diesel oil were used in the trials.

Basudin was obtained as 60 per cent emulsifiable concentrate from Messrs Geigy Insecticides, Ltd. It is an organic ester of phosphoric acid, containing diazinon as the toxic ingredient. It was diluted by adding one part of the concentrate to 1,600 parts of water to obtain 0·036 per cent diazinon content.

Folidol E. 605 was obtained from Messrs Chika Limited. It contains 46·6 per cent of parathion in concentrated emulsion. It was diluted by adding 1·6 ounces of the emulsifiable concentrate to 16 gallons of water, so as to obtain a concentration of 0·03 per cent parathion in the spraying solution.

Malathion was obtained as 50% emulsifiable concentrate. It was diluted by adding 10 gallons of water to 3 ounces of the concentrate to obtain 0·09 per cent toxic ingredient (S-dicarboethyoxy—ethyl—dimethyl—dithiophosphate).

DNOC Winter Wash was obtained from Messrs Burmah Shell as concentrated emulsion containing 1·62 per cent of the toxic ingredient (sodium salt of 4, 6-dinitro-ortho-cresol) by weight. It was diluted by adding seven parts of the emulsion to 93 parts of water to get a concentration of 0·113 per cent DNOC.

Diesel oil emulsion was prepared locally by taking one gallon of light diesel oil and emulsifying it with 3 pounds of potash fish oil soap in 28 pounds of water by heating. The stock solution thus obtained was diluted by adding one part of it to 6 parts of water to give an oil concentration of 3·48 per cent.

(*b*) *Selection of trees and sampling for population counts.*—Some apple trees in Roga orchard situated near Kotgarh, about 52 miles from Simla and belonging to one Shri P. C. Singha, showing a fair degree of scale infestation were selected for the trials. About 70 trees were examined at random in the lower Roga valley and out of them, 36 trees showing almost equal infestation by the pest were finally marked out for the test.

Population counts of the pest were taken in the selected trees before spraying. For this purpose small pieces of bark of a specific unit area (about half to one sq. inch) were removed from six places on each tree at random. Each piece of bark was examined under a binocular microscope and the number of living and dead scales counted by removing their scaly coverings with a needle. Thus, a total of 216 (6×36) samples were examined in each round.

There were, in all, six treatments including the 'check' or 'no treatment'. For each of these treatments, six trees were marked out, which were sprayed with one of the five insecticides mentioned above. Thus, 30 (6×5) trees were sprayed, while the remaining six trees were left unsprayed to serve as 'check' for comparison.

The efficacy of the treatment in causing mortality of the pest was assessed by counting the scale population at 3 different times after treatment during the dormant season and for a fourth time during the spring season (April), when the pest and the plant revived their activities. The first post-treatment reading was taken one week after spraying, while the second and third readings were taken 15 and 40 days after spraying, respectively. The fourth post-treatment count was taken in the second week of April, about $4^1/_2$ months after treatment. The spraying operations were conducted early in the day by one man all through so as not to introduce any personal variations in the method of spraying. The spraying was done so thoroughly as to drench the trees completely without leaving any spot untreated. The spraying was carried out by means of a new Maruti foot pump, giving a pressure of about 100 pounds per square inch.

Evaluation of Results

The percentage mortality of the pest was worked out on the basis of the total population of the living and dead scales in the sample. These percentages were transferred according to the formula $C=\sin^{-1}\sqrt{p}$ where 'p'

denotes the % mortality and C the transferred variate. The sums of their totals for statistical analysis are shown in the table below:—

Sum totals of Sin$^{-1}\sqrt{p}$ values of Treatments and Time effects

TIME OF TAKING OBSERVATION

Treatment	T1	T2	T3	T4	Total	Mean of Treatments
1. Basudin ..	330·4	426·7	328·1	477·8	1563·0	65·12
2. Malathion ..	315·3	343·1	290·7	426·1	1375·2	57·30
3. Folidol ..	314·7	331·8	314·9	443·2	1404·6	58·52
4. DNOC ..	371·8	414·4 (*a*)	360·1	419·8	1566·1	65·25
5. Diesel Oil ..	329·6	448·8	303·2	410·7	1492·3	62·18
6. Control ..	280·8	299·8 (*b*)	236·1	291·9	1108·6	46·19
TOTAL ..	1942·6	2264·6	1833·1	2469·5	8509·8	—

(*a*) and (*b*) represent missing values, estimated according to the principle of least squares. T1, T2, T3, and T4 represent the time of taking population counts *viz.* one week, two weeks, 40 days and 4½ months after spraying, respectively.

ANALYSIS OF VARIANCE

Variates Due to	Degrees of Freedom	Sum of Squares	Mean of Squares	Value of F
Treatment	5	2575·69	515·14	11·97
Time	9	3611·59	1203·86	27·98
Interaction	15	13851·73	923·44	21·46
Error	108	4646·33	43·02	—
TOTAL	137	24685·34	—	—

Critical difference :—8·217 at 1% level and
10·861 at 5% level

It will be seen from the analysis of the data shown above that the effects of the various insecticides were highly significant at 1% level. Basudin, DNOC and diesel oil emulsions proved more effective than Malathion and Folidol. As compared to control, the transformed mean values for Basudin and DNOC were almost equal, being 65·12 and 65·25 respectively. The critical difference at 1% level being 10·861, the values when compared with control or no treatment (46·19) are very highly significant. Of these two insecticides, Basudin could be considered more reliable than DNOC, as in the latter case one observation, which was missing, had to be estimated on the principle of least squares. Diesel oil, showing a mean value of 62·18%

is also significant, when compared with control, but shows lower values than Basudin and DNOC. Malathion and Folidol did not prove effective.

The above analysis shows that the interaction between treatment and time effects was also highly significant, meaning thereby that the insecticides were effective after a certain lapse of time. A similar analysis of variance for time effect, taking pretreatment counts (before spraying) as control, was also worked out and the values obtained were as follows:—

Mean values of the effect of spraying at different times after spraying

Pretreatment	*One week after treatment*	*Two weeks after treatment*	*40 days after treatment*	*4 1/2 months after treatment*
41·82	53·96	63·41	50·92	68·59

Critical difference:—12·2696 at 5% level
16·1257 at 1% level

Values are based on $\text{Sin}^{-1}\sqrt{P}$

According to the above values, the treatments were not effective within one week of spraying, showing less than critical difference when compared with control. The effectiveness of the treatments became very evident two weeks after the treatment (63·41). Again, when the population counts were taken during the spring season, when the pest revived its activity, with a view to assess the overall effect of the treatment on the multiplication of the pest, the results were very encouraging, showing a value of 68·59, which is significant at 5% level. Some previous workers (Abbott, 1926) have stated that a period of about one month should elapse before assessing the effect of oil emulsions, but the above observations show that the effectiveness of the insecticides can be assessed after a lapse of a fortnight from the time of spraying. Swingle and Snapp (1931) believe that an interval of one month between the time of spraying and the taking of mortality counts is too wide, as results may be vitiated by deaths due to natural causes.

Discussion

Climatic and weather conditions play an important role in influencing the effectiveness of insecticides. The effect of Parathion (Folidol E.605) on San Jose Scale infesting apples was investigated by Gerhard Schumann in Germany. He found that Folidol E.605 was most effective during autumn and summer months, causing 97·8% to 99·9% mortality of the pest, while at low temperatures during winter (December to April) the mortality of the pest did not go over 30%. Temperatures ranging between 60° F and 70° F and above were found most favourable for the effectiveness of the insecticide. In Himachal Pradesh the results were less encouraging, probably because of the fact that the temperature prevailing at the time of the trials was below 50° F.

The residual power of the insecticide influences the possibility of re-infestation by the pest considerably. In the case of Folidol it was found

that at 0·05% concentration it was effective for 13 to 20 days, while at 0·03% the effectiveness lasted about 11 days. As the trials were conducted with 0·03% of Parathion in Himachal Pradesh during winter months, when the temperature was also not favourable, the effectiveness of the insecticide and its residual effect were much lower than in the case of other insecticides. The same factors are likely to have influenced the effect of Malathion also.

Besides climatic and other factors, the degree of absorption of the insecticide by the bark of the plant and its retention in the lower corticle layers, as well as the stage of development of the pest dealt with, are also important factors. The greater the retention of the insecticide in the corticle layer, the longer is the efficacy of the insecticide in preventing recolonisation by the pest. The younger scales are easier to control than the older stages, which can resist the insecticides to some extent.

The efficacy of the various oil sprays also depends very much on the physical properties of the oil in the emulsions. Such properties as volatility, viscosity and purity of the oils make them suitable or otherwise as insecticides. Oils which are lighter and at the same time toxic to the scale are better, as they do not cause phytotoxicity. Oils with viscosity between 100—200 (Saybolt) at 100° F were found quite effective in U.S.A. during the dormant season. Oils freed of unsaturated hydrocarbon impurities are more effective. The oil contents of the emulsions should be so much as to cause maximum mortality of the pest without causing any injury to the plants in the season. The concentration of oils which may be effective during the dormant season may cause injury to the plant if used during summer. In Kashmir, 4·5% oil in diesel oil emulsion proved effective when the infestation was light. In the case of heavy infestations, even 7·5% oil in the emulsion was used without injuring the plants during the dormant season. In the present trials, 3·48% of light diesel oil was used and it was quite likely that the effectiveness might have increased if the concentration of the oil was higher. In the case of Basudin, on the other hand, it might be possible to find a lower dilution of the insecticide which will be equally effective. Further trials to establish the minimum effective dose would be useful. To estimate the superiority of the newer synthetic preparations, in the doses tested, the costs of 10 gallons of the solutions of the various insecticides were worked out. It was found that the costs of Basudin, DNOC, Malathion, Folidol and diesel oil emulsions were Rs. 2-3-0, Rs. 4-2-0, Rs. 1-9-0, Rs. 1-8-6 and Rs. 1-8-0, respectively.

As already stated, Basudin and DNOC caused higher mortality of the pest. DNOC, being most expensive, would not prove economical. Basudin could, therefore, be considered the best of all. If the concentration of Basudin could be brought down from 1 in 1,600 to 1 in 1,900, it would prove more economical than diesel oil emulsion. There are some indications that Basudin might prove equally effective in this lower dilution also.

All the five newer insecticides tested should be handled with great care, as they involve toxic hazards to the operators. Protective coverings such as gloves, gum boots, goggles, gas masks, etc., should be used while handling the solutions and spraying them on the trees. Special care is necessary in handling concentrated emulsions while taking them out of the containers for diluting them.

Acknowledgment

We thank the Director of Agriculture, Himachal Pradesh, and the owner of the Roga orchard, Shri P. C. Singha, for the facilities afforded by them for carrying out these trials. We are grateful to Dr. K. B. Lal, Plant Protection Adviser to the Government of India, for the guidance given by him in the course of this work.

References

1. Abbott, W.S.(1926) *J. Econ. Ent.*, **19**(6): 858—860

2. Swingle H. S. and Snapp, O.I. (1931) *Bull. U.S. Bur. Ent., No.* **253**: 48

CHEMICAL CONTROL OF *ASPHODELUS TENUIFOLIUS*

By

A. P. Misra,

Assistant Systematic Mycologist,

Directorate of Plant Protection, Quarantine & Storage,

New Delhi.

Asphodelus tenuifolius (Family Liliaceae) is a serious weed (local name *piazi*) in Delhi State, Punjab, Rajasthan, and western districts of Uttar Pradesh. It is an annual, with semi-terete fistular leaves borne on a very much reduced axis. The scapes, bearing racemes, arise in between and are much branched. The flowers are white and liliaceous. The capsules are globose, about 4-5 mm. in diameter and bear hard, black, trigonous seeds.

The weed is common in arable lands during the *rabi* (October—April) season, and is a regular menace to wheat, barley and gram cultivation. If periodical weeding is not meticulously followed, the severity of infestation rapidly increases and during the course of 2 or 3 years the fields are entirely over-run by this weed. As the infestation increases, the removal of the weed by mechanical means becomes more laborious and costly. Two important factors contributing to the rapid spread of the weed are its flowering and fruiting habits. The flowering is spread over a long period, commencing from January and continuing till the middle of March. Seed formation is also likewise spread over a long period. The mature seeds fall on the ground when the capsule ripens. The plants start producing flowers and seeds when they are fairly young and continue to do so till they are old. Twenty-five plants picked at random revealed the presence of 40 to 310 fruits per plant with an average of 191. This variation seems to be influenced by the general vigour of the plants, which depends upon the climate, soil, irrigation, crop and the density of the weed population.

The control of this weed by mechanical means is difficult because the seeds germinate over a long period of time necessitating several rounds of weeding. In view of the severity of the problem attempts were made to control the weed by the use of Sodium tricholro acetate, which is known to be effective against Gramineae.

Preliminary field tests were made early in January, 1954, against *Asphodelus* infesting mustard fields. Both the weed and the crop were in the vegetative stage. Sodium trichloro acetate was sprayed at a concentration of 1 oz. in 2½ gallons of water, with Enot's pedal pump using 200—250 gallons of water per acre. After a fortnight of spraying, the leaf tips of some weed plants dried up, followed by curling and twisting of the leaves. In addition some of the leaves were cemented together for part of their lengths.

Later observations showed that the sprayed plants were stunted in growth, resulting either in the complete suppression of flower formation or in their failure to develop normal flowers. Some of the flowers dried up in rudimentary stages and in other cases the perianth leaves were cemented together and the flowers failed to open. The chemical failed to kill the plants completely. The crop plants remained almost unaffected.

In another test against *Asphodelus* in a small plot of wheat crop, similar results were obtained. But in this case the wheat crop was also adversely affected and the plants were comparatively stunted in growth.

The trials were repeated in February, in plots of lentil in the flowering stage, heavily infested with *Asphodelus* mostly in the vegetative and flowering stages, with fruit formation commenced on some plants. Sodium trichloro acetate in concentrations of 1 oz. in 2½ gallons and 1 oz. in 5 gallons per acre was used. The plants were sprayed with Enot's pedal pump, using about 200—250 gallons of spray liquid per acre. As the lentil crop was in the flowering stage, care was taken to avoid the drift of the spray liquid on the crop, as far as possible. The sky was clear at the time of spraying but there had been light to moderate showers for a day or two in the week before and after spraying.

Final observations were made after 45 days, when results were most pronounced. At both concentrations, there was curling and twisting of the inflorescence axes and of some leaves, and cementing together of the latter for most or part of their lengths. The plants were slightly stunted, the flowers mostly dried up or failed to open and the perianth leaves appeared to have been glued together. Fruit and seed formation was almost completely suppressed. A few fruits that were present failed to develop normal seeds, which in most cases were rotten or aborted.

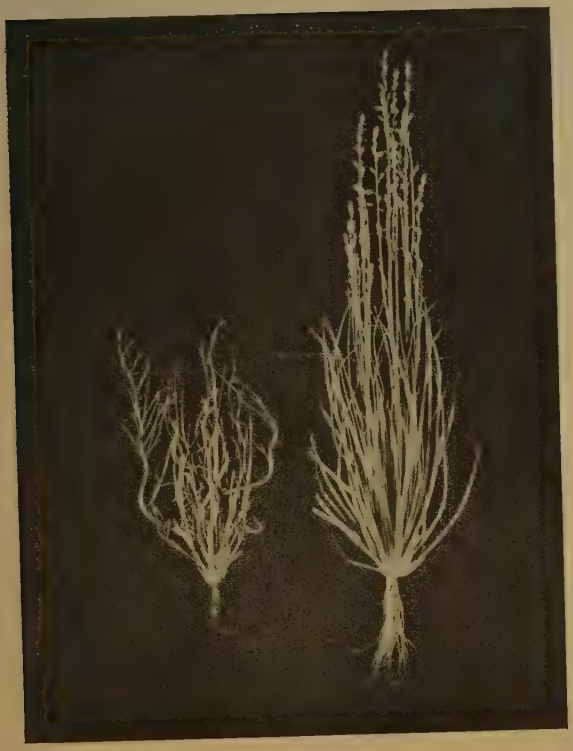
Table 1 shows the number of fruits from 25 plants, picked at random from sprayed and unsprayed plots, together with measurements of the average height of plants and the length of roots, taken 52 days after spraying.

Since the plants were sprayed in an advanced stage of growth, marked differences in the average height of the scapes were not expected, though there was appreciable dwarfing of the roots. The unsprayed plants were fruiting abundantly and bore 40—310 fruits per plant, with an average of 191. In marked contrast to this, the plants sprayed with the higher concentration of the herbicide had a range of 0—14 fruits per plant with an average of 2 and those sprayed with a lower concentration had a range of 0—34 with an average of 6. None of the plants bore normal fruits and most of the fruits that developed were unhealthy, either rotten or aborted.

The trials were repeated in 1955 and weed plants in varying stages of growth were sprayed on different dates and in different localities.

Effect of Sodium trichloro acetate on *Asphodelus tenuifolius* in different stages of growth

Unsprayed Sprayed



Sprayed Unsprayed


ONOPHYLL
4 RAYED

Plants in the early vegetative stage, sprayed with a concentration of 1 : 400, developed no fruits at all and were considerably stunted and deformed and had poorly developed roots (Table 2). In more advanced vegetative stages and at concentrations of 1 : 400 and 1 : 800 of the herbicide, the average numbers of fruits per plant were 0·6 and 4·1 respectively, as against 45·4 in the control plots. There was also appreciable reduction in the height of the plants and the length of the roots, accompanied by usual malformations of the plants (Table 3). In the flowering and fruiting stages of the weed, the average numbers of fruits per plant for the two concentrations of the herbicide were 7·6 and 25 respectively, as against 204 in unsprayed plots. There was also appreciable reduction in the height of the plants and the length of the roots (Table 4).

The trials were carried out on five different occasions during 1954 and 1955. The plants were sprayed in the early vegetative, advanced vegetative, flowering, and early fruiting stages of the weed, during the months of January and February in different localities, with the object of studying the effects of the weedicide under different crop, soil and climatic conditions available in Delhi State. The results were fairly consistent. The flowers either failed to develop at all or dried up in early rudimentary stages. In other cases, the perianth leaves appeared to be cemented together and the flowers failed to open or were otherwise malformed. Flowers present at the time of spraying either withered up or failed to set normal fruits. Young fruits were either aborted or rotten or had unhealthy seeds. In some cases, the seeds were observed to be very brittle and could be easily powdered between the fingers.

It would thus appear that a single spray application at the vegetative and early flowering stages of the weed, during January and February, may considerably reduce the weed infestation in subsequent years.

The cost of the weedicide, sprayed at the lower concentration (1 : 800 at 200 gallons per acre) works out to about Rs. 6-4-0 per acre. In heavily infested areas this should not be an uneconomical or unpracticable proposition.

In the trials carried out, there seemed to be no appreciable damage to the dicotyledonous crops, mustard and lentil, which may be very adversely affected by 2, 4-D and other hormone type weedicides.

If the proper dosages and the time of application are carefully worked out, the weedicide may be used against *Asphodelus* in several crops.

Acknowledgment

The writer is grateful to Dr. P. R. Mehta, Deputy Director (Plant Diseases), Directorate of Plant Protection, Quarantine and Storage, New Delhi, for invaluable encouragement in this work and helpful suggestions in writing this paper.

TABLE 1

Effect of Sodium T.C.A. on Asphodelus tenuifolius *in advanced vegetative and flowering stages*

		Sprayed plants (Concentration of Weedicide)		Unsprayed plants
		1 : 400	1 : 800	
Average height of plants in inches		17·5	17·9	18
Average length of roots in inches		3·5	3·7	4·6
No. of plants bearing fruits		9	13	25
*Number of fruits per plant ..	RANGE ..	0–14	0–34	40–310
	AVERAGE ..	2	6	191

*Fruits in many cases rotten and with few or no seeds.

TABLE 2

Effect of Sodium T.C.A (1 : 400) *on* Asphodelus tenuifolius *in early vegetative stage*

	Sprayed plants	Unsprayed plants
Average height of plants in inches	8·3	19·1
Average length of roots in inches	1·2	2·1
No. of plants bearing fruits	0	25
Average No. of fruits per plant	0	45·4

TABLE 3

Effect of Sodium T.C.A. (1 : 400 & 1 : 800) *on* Asphodelus tenuifolius *in more advanced vegetative stage*

	Sprayed plants (Concentration of weedicide)		Unsprayed plants
	1 : 400	1 : 800	
Average height of plants in inches	13·1	15·8	19·1
Average length of roots in inches	1·5	1·8	2·1
No. of plants (out of a total of 25) bearing fruits ..	6	15	25
Average No. of fruits per plant	0·6	4·1	45·4

TABLE 4

Effect of Sodium T.C.A. (1 : 400 *and* 1 : 800) *on* Asphodelus tenuifolius *in flowering and fruiting stages*

	Sprayed plants (Concentration of weedicide)		Unsprayed plants
	1 : 400	1 : 800	
Average height of plants in inches ..	18·5	17·2	22·3
Average length of roots in inches ..	3·14	2·2	4·1
No. of plants bearing fruits ..	17	25	25
Average No. of fruits per plant ..	7.6	25	204

SHORT NOTES

(*i*) "SPIKE", A NEW DISEASE OF SUGARCANE IN BIHAR*

A new malady, probably of virus origin, has recently been noted in Co. 419 in the *Gur* areas of Kharagpur and Ghosi respectively in Monghyr and Gaya districts in South Bihar and in B.O. 11 in the Warisaliganj factory reserved area in the latter district. It manifests itself at all stages of growth by the reduction of leaves (both lamina and sheath) and internodes to varying degrees and by the sprouting of one to several or even all the buds, depending upon the intensity of the malady. A typical case with high degree of disturbance resembles a "Spike" in the earlier stages of the malady and hence the name of the disease. In later stages, when all the buds have sprouted *in situ*, it presents a bushy appearance especially at the top. One-budded setts from mildly-affected stalks planted on July 23, 1956 produced in some cases, mother shoots with distinct indications of the disease. (Central Sugarcane Research Station, Pusa, Bihar).

(*ii*) SAFETY TIPS FOR USING PESTICIDES†

1. Always read the label before using pesticide sprays or dusts. Note warnings and cautions each time before opening container.

2. Keep sprays and dusts away from children, pets and irresponsible people. Store pesticides in a secure place away from food and feed.

3. Don't smoke while spraying or dusting, and avoid inhaling sprays or dusts.

4. Do not spill sprays or dusts on the skin or clothing. If they are spilled, remove contaminated clothing and wash exposed skin areas thoroughly.

5. Use separate equipment for applying hormone-type herbicides to prevent accidental injust to susceptible plants.

6. Dispose of empty containers so that they pose no hazard to humans, animals or valuable plants.

If symptoms of illness occur during or shortly after spraying or dusting, call a physician or get the patient to a hospital immediately. Physicians now have available information for the quick and effective treatment of accidental over-exposure to pesticides.

---

*[Extract from the *Indian Journal of Sugarcane Research and Development*, 1 (2), 1957, 105]

†[Extract from the *National Agricultural Chemicals Association News*, 15 (2), 1957, 4]

M67Mof F&A—Sc. I—500—2-6-59—GIPF.